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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/631,805	08/03/2000	Rajiv Laroia	20-6	9145

7590 06/28/2004

EXAMINER	
TRAN, KHANH C	

ART UNIT	PAPER NUMBER
2631	

DATE MAILED: 06/28/2004

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/631,805	Applicant(s) LAROIA ET AL.	
	Examiner Khanh Tran	Art Unit 2631	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *08 April 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *1-16* is/are allowed.

6)☒ Claim(s) *17-20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *08 April 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1. The Amendment filed on 04/08/2004 has been entered. Claims 1-20 are pending in this Office action.

Response to Arguments

2. Applicant's arguments with respect to claims 17-20 have been considered but are moot in view of the new ground(s) of rejection.

3. The formal drawings filed on 04/08/2004 has been accepted by the Examiner.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 17-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kuwahara et al. US. Patent 6,597,678 B1.

Regarding claims 17-19, Kuwahara et al. invention is directed to a base station using an adaptive array antenna and included in a radio communication system represented by a cellular radio communication system. Kuwahara et al. teachings apply to a system employing a code-division multiple access (CDMA

system). Figure 2 illustrates a radio communication base station in a first embodiment.

In column 3 line 66 through column 4 line 64, information (from a mobile station) received by the antennas 100 is down-converted by an RF circuit 101, and a despreading system 102 despreads the down-converted information by an appropriate code sequence of an appropriate phase. A spatial correlation matrix estimating circuit 106 calculates a special correlation matrix R by using Expression (1). The spatial correlation matrix provides a correlation between signals received at different antenna elements within the antenna array, and hence, corresponds to the claimed spatial covariance matrix. Kuwahara et al. does not expressly disclose determining spatial correlation matrix at least in part based on unique hopping sequence of the mobile station. As recited above, Kuwahara et al. teachings apply to a system employing a code-division multiple access (CDMA system). However, as well known in the art of CDMA communication system, CDMA system based on frequency hopping spread spectrum signals have been used widely in wireless communication applications. In light of the forgoing, it would have been obvious for one of ordinary skill in the art at the time the invention was made that Kuwahara et al. CDMA system can be modified to utilize frequency hopping spread spectrum signals, and the spatial correlation matrix calculated for each mobile station is determined based on inherent unique hopping sequence of the mobile station as claimed in the pending patent application.

In column 5 lines 45-54 and in the abstract, an optimum downlink array weight is estimated on the basis of an array response vector obtained from a signal subspace estimation 108 and interference subspace estimation 107. The signal subspace estimation and interference subspace estimation are derived from the correlation matrix estimation 106. In light of the foregoing, the correlation matrix estimation is processed to produce an optimum downlink array weight, corresponding the claimed step of processing the estimated spatial covariance.

Referring to figure 2, the array control for downlink 109 applies the estimated downlink array weight to a beamforming for downlink 114 which facilitates detection of a transmitted symbol as claimed in the pending patent application.

Regarding claim 20, claim 20 has similar scope as claim 19 and is rejected on the same ground. Furthermore, it would have been obvious for one of ordinary skill in the art that correlation matrix estimation 106, signal subspace estimation 108, interference subspace estimation 107, array control for downlink 109, and beamforming for downlink 114 constitutes the claimed processor operative as set forth in the claim.

Allowable Subject Matter

5. Claims 1-14 are allowed.

Regarding claim 1, said claim is allowed because prior art of record, US Patent 6,597,678 B1, discloses all the limitations of claim 1, but the uniquely distinct features "***estimating an array response for the given mobile station from the interference matrix***". On the contrary, the prior art of record, instead, teaches *the array response vector is obtained from a signal subspace.*

6. Claim 15 is allowed.

Regarding claim 15, said claim is allowed because prior art of record, US Patent 6,597,678 B1, discloses all the limitations of claim 15, but the uniquely distinct features "***to estimate an array response for the given mobile station from the interference matrix***". On the contrary, the prior art of record, instead, teaches *the array response vector is obtained from a signal subspace.*

7. Claim 16 is allowed.

Regarding claim 16, said claim is allowed because prior art of record, US Patent 6,597,678 B1, discloses all the limitations of claim 16, but the uniquely distinct features "***means for estimating an array response for the given mobile station from the interference matrix***". On the contrary, the prior art of record, instead, teaches *the array response vector is obtained from a signal subspace.*

Conclusion

8. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Don Torrieri and Kesh Bakhru, "Adaptive and Diversity Arrays for Frequency-Hopping Systems", Military Communications Conference Proceedings, 1999, MILCOM 1999, IEEE, Volume: 2, 31 Oct. – 3 Nov. 1999, pages: 929 – 933.

Jung et al. U.S. Patent 6,480,153 B1 discloses "Calibration Apparatus of Adaptive Array Antenna and Calibration Method Thereof".

Olenick et al. U.S. Patent 4,998,290 discloses "Frequency-Hopping Radio Communication Network".

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Khanh Tran whose telephone number is 703-305-2384. The examiner can normally be reached on Tuesday - Friday from 08:00 AM - 05:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mohammad Ghayour can be reached on 703-306-3034. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

KCT

JEAN B. CORRIELUS
PRIMARY EXAMINER
6/22/04